

**JORDANOPSYLLA BECKI (SIPHONAPTERA: CTENOPHTHALMIDAE),
A NEW SPECIES OF FLEA FROM THE NEVADA TEST SITE**

MICHAEL W. HASTRITER

Monte L. Bean Life Science Museum, Brigham Young University, 290 MLBM, P.O. Box 20200, Provo, UT 84602-0200, U.S.A. (e-mail: hastritermw@sprintmail.com)

Abstract.—*Jordanopsylla becki*, a new species of flea collected 1.25 km north of Mercury, Nevada Test Site, Nye County, Nevada, from *Neotoma lepida* is described and illustrated. This flea, assigned to the subfamily Anomiopsyllinae, tribe Jordanopsyllini, is a nest flea found as an adult only during the winter months. Techniques for recovering this rare flea are described.

Key Words: flea, Nevada, *Jordanopsyllini*, *Neotoma*

Traub and Tipton (1951) erected a new genus and tribe in the subfamily Anomiopsyllinae for two females of the rare flea, *Jordanopsylla allredi*. Only 12 specimens (9 ♂, 3 ♀) of this species have been collected and the male was only recently described by Hastriter, Egoscue and Traub (1998). Morphological details described by the latter authors also support the systematic position of the genus in the subfamily Anomiopsyllinae, tribe Jordanopsyllini as previously described by Traub and Tipton (1951). Beck and Allred (1966) reported five (3 ♂, 2 ♀) additional specimens of *J. allredi* from the northwest slopes of the Spotted Range and Red Mountain, Nevada Test Site (near Mercury), Nye County, Nevada and subsequently provided these specimens to the late Robert Traub. Traub concluded that they represented a new species. Prior to his death, he kindly submitted these five specimens to me for description. Because of the dearth of material belonging to this genus, I sought more specimens of this new species by collecting on the northwest slope of Red Mountain during January 12–14, 1999. The Spotted Range was not accessible during this collection trip.

After nearly 50 years of intensive collection efforts, *Jordanopsylla* is represented by only two taxa. Most of the specimens (with the exception of recent collections) of both taxa were either collected by, or under the direction of D. M. Allred and D. E. Beck, Brigham Young University. Since the nominate species was named after Allred, it seems fitting to name this new species after Beck, honoring the team efforts of both of these naturalists who contributed so much toward our understanding of the Siphonaptera of the Great Basin and the northern fringes of the Mojave Desert.

MATERIALS AND METHODS

Aluminum collapsible Sherman® traps baited with oatmeal were set at three sites on January 11–13, 1999 [(Site 1) 36°41.5'N, 115°58.8'W, (Site 2) 36°41.7'N, 115°58.3'W, and (Site 3) 36°42.6'N, 115°59.5'W]. Sites 1 and 2 had steep slopes with rocky limestone outcroppings, cliffs, and talus. Dominant vegetation included sparsely distributed black brush (*Coleogyne ramosissima* Torr) and yucca (*Yucca schidigera* Roezl ex Ortega). The slope of site 3 was more gentle than that of sites 1 and

2 with scattered basalt rock. Black brush, creosote (*Larrea tridentata* Coville), and yucca were the predominant vegetation at site 3.

Mammals were shaken from traps directly into white cloth bags (23 × 28 cm) each morning and processed immediately after collection for fleas. The number of mammal specimens of each species that could be retained was restricted by permit, necessitating release of some. Only fleas that escaped in the bags were obtained from animals that were released. Other mammals were sacrificed by cervical fracture, while in the bags. The entire contents of each bag (mammal, fleas, and debris) were emptied into a white 19 liter bucket. The mammal was held below the level of the top of the bucket while blowing a gentle stream of CO₂ over the pelage to excite the fleas to vacate the animal. Because all fleas do not become agitated by CO₂, each animal was also combed briskly with a toothbrush (with a single row of bristles). Hosts placed in individual plastic bags were frozen at the end of each day. Upon return to the laboratory, they were individually washed by rapidly stirring the frozen animal back and forth in a 3.8 liter jar filled half full with tepid tap water. The water was poured into a white enamel pan and fleas flushed from the animal's fur were collected.

Nests of *Neotoma lepida* Thomas were collected from site 1 (N = 7) and site 3 (N = 4). Each was placed in a plastic bag, sealed, and returned to the laboratory. Fleas and flea larvae were collected by placing the 11 nests in Berlese funnels for 48 hours (two nests were combined in each of four funnels and three in a fifth funnel).

RESULTS

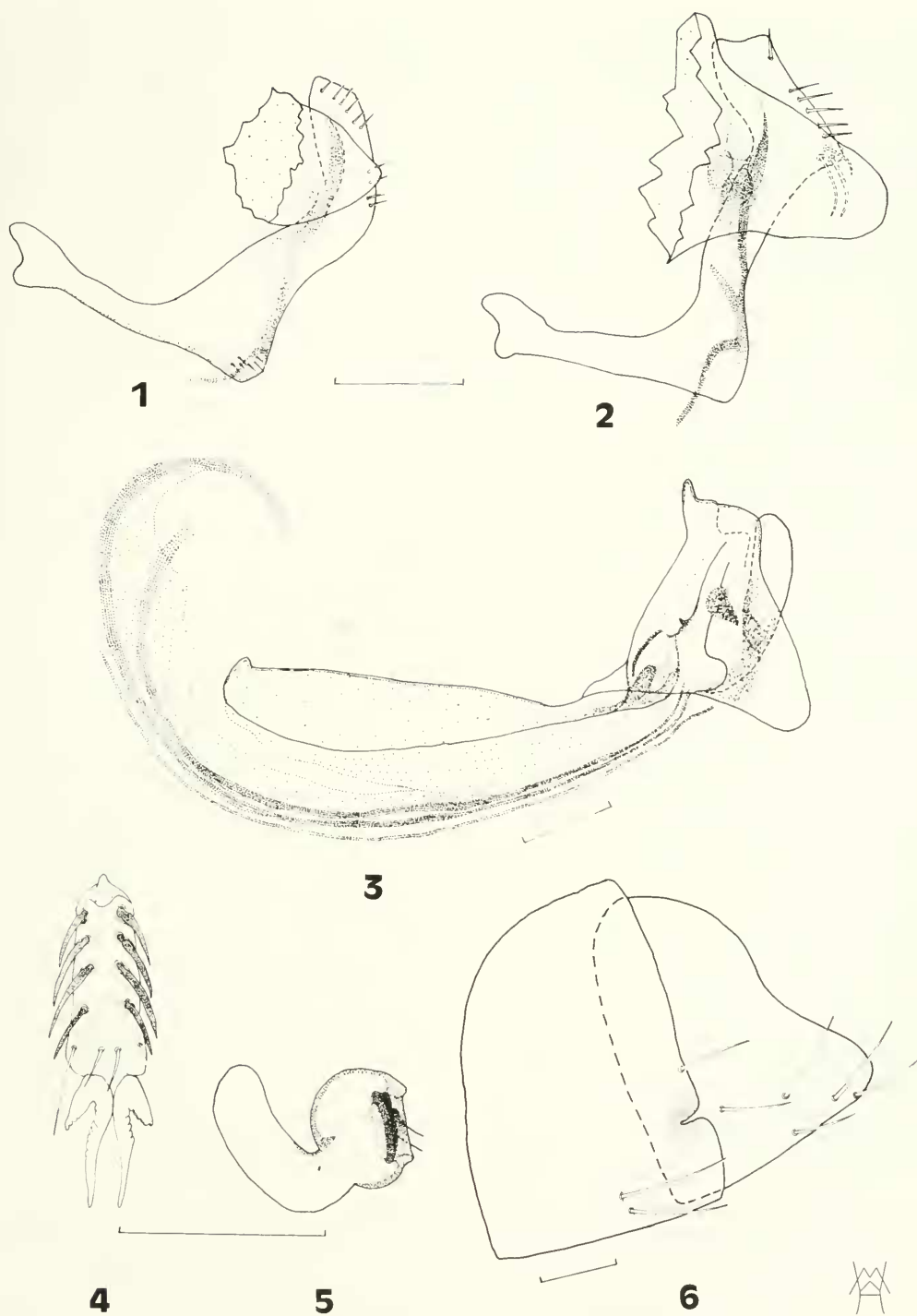
Seventy-three mammals [*Peromyscus crinitus* (Merriam) (N = 42), *N. lepida* (N = 19), *Peromyscus eremicus* Baird (N = 7), *Peromyscus maniculatus* (Wagner) (N = 2), *Onychomys torridus* (Coues) (N = 2), and *Dipodomys ordii* Woodhouse (N = 1)] were collected during 280 trap nights. *Peromys-*

cus crinitus and *N. lepida* comprised 84% of the mammals trapped. One hundred sixty-four fleas [*Orchopeas sexdentatus agilis* (Rothschild) (N = 82), *Malariaeus sinomus* (Jordan) (N = 74), *Anomiopsyllus amphibolus* Wagner (N = 4), *J. becki* n. sp. (N = 2), *Stenistomera alpina* (Baker) (N = 1), and *Carteretta clavata* Good, (N = 1)] were obtained from mammals (none from *O. torridus* or *D. ordii*) and 126 fleas [*O. s. agilis* (N = 91), *A. amphibolus* (N = 32), and *J. becki* (N = 3)] were obtained from nests. Two *Jordanopsylla* females were recovered from the pelage of two adult *N. lepida* females during washing, while none were collected from the animals during thorough field processing. A male and female *Jordanopsylla* were each collected from a composite of two nests from the same Berlese funnel and an additional female from three *N. lepida* nests combined in another funnel. All five specimens of *Jordanopsylla* were collected between 1,225 m and 1,305 m.

Nests of *N. lepida* are usually difficult to obtain, since they are frequently established in inaccessible rock areas or deep within ancient wood rat middens. The author discovered that the wood rats living among *Y. schidigera* almost always built their nests at the base of a dead yucca stump. Nests could seldom be located unless the healthy yucca stands (two or three stalks) contained a dead stump. The central core of the woody stock decay, leaving a hard outer surface covered with dead spear-like leaves. These stumps provide protection for *N. lepida* and an environment for flea development during extreme desert conditions. By carefully pulling the dead stumps over, the decayed root system exposes the wood rat nest centrally located beneath. With care, the stumps may be turned over, the nest collected, and the stump replaced, minimally disturbing the building site for future wood rat nests.

Jordanopsylla becki Hastriter, new species (Figs. 2–6)

Type data.—Holotype (1 ♂, field no. 734), ex *Neotoma lepida*, 1.25 km north of



Figs. 1-6. *Jordanopsylla* spp. 1, *J. allredi*, ninth sternum and lateral lobe of aedeagus. 2-6, *J. becki*. 2, ninth sternum and lateral lobe of aedeagus. 3, aedeagus. 4, metatarsus (holotype). 5, spermatheca. 6, female sixth and seventh sternites (note: sinus in posterior margin of st. VI). Scale = 100 μ .

Mercury, Nevada Nuclear Test Site, Nye County, Nevada, October 28, 1961, collector "5HR"; allotype (1 ♀, field no. 723), same data except collector "MCD" and paratypes (2 ♂, field no. 670 each), same data except collector "5HR"; paratype (1 ♀, field no. 647), same data except November 10, 1961; and paratypes (1 ♂, 1 ♀, field no. MH-446/447, 1 ♀, field no. 451, 1 ♀, field no. 464, and 1 ♀, field no. 472), 1.25 km north of Mercury on northwest facing slope of Red Mountain, Nevada Test Site, Nye County, Nevada (36°41'N, 115°58'W), elev. 1,225–1,305 m, January 12–13, 1999, M. W. Hastriter. Holotype, allotype, and three paratypes (2 ♂, 1 ♀) are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.; one paratype (♀) in the Robert E. Lewis collection; and four paratypes (1 ♂, 3 ♀) in the author's collection.

Diagnosis.—Males of *Jordanopsylla becki* differ from those of the nominate species in the shape and setation of st. IX and the extended length of the lateral lobe of the aedeagus. The ventral caudal margin of the apical lobe of st. IX is distinctly angular, bearing two or three well-developed setae, whereas in *J. allredi* it is evenly rounded without conspicuous setae. The apex of the lateral lobe (lateral lobe fused to st. IX in both species) extends well beyond the posterior margin of the apical lobe of st. IX in *J. becki* and extends only to the margin in *J. allredi* (Figs. 1–2). Caudal margin of st. VII of female is similar to *J. allredi* with a broad, shallow concavity subtended by a weakly developed ventral lobe (Fig. 6), however, the setation differs. The st. VII of the new species has two parallel oblique rows of setae per side (two anterior and three posterior). *Jordanopsylla allredi* has only a single oblique posterior row of five slender setae per side and four smaller setae per side anterior to the oblique row. The smaller setae are arranged in pairs along the ventral margin at the level of the ventral most seta of the oblique row. *Jordanopsylla becki* females also have a markedly scler-

otized zone surrounding a distinct sinus on the caudal margin of the st. VI (Fig. 6). This sclerotization is not apparent in the female holotype of *J. allredi*. Although the latter holotype was drastically over-cleared, it is doubtful that over-clearing could obliterate the heavy sclerotization noted in *J. becki*. Collection of additional females of *J. allredi* may substantiate or refute this observation. It is noteworthy, that *Jordanopsylla* is the only genus in North America with a distinct sinus in st. VI, a feature shared only by species of *Tetrapsyllus* (*Tetrapsyllus*) Jordan that occur in western South America from Ecuador south into Chile and Argentina.

Description.—*Male. Head:* Frons smoothly rounded without frontal tubercle. Incrasation at oral angle, 2 marginal placoid pits in preantennal region, and a single placoid pit in lateral occipital area. Depth of occipital groove nearly equal to width of first segment of maxillary palpus. Eye moderately well developed, ventrally notched. Tentorial arm anterior to eye. Preantennal setae with ocular row of 3, upper and lower longer than middle seta. Setae in occipital area restricted to posterior row of 4–5 setae per side, most ventral seta largest and set slightly anterior to row. Dorsal margin of antennal fossa with line of 23–24 minute coniform setae. Scape bearing 1 small dorsal seta, 3 along apical margin, pedicel not over-lapping onto clavus, with 3 setae $\frac{2}{3}$ length of clavus. Proximal half of maxilla sclerotized, distal half transparent and difficult to distinguish, rounded apex extending half the length of first segment of labial palpus. Maxillary palpus of 4 segments, each similar in length. Labial palpus of 5 segments, terminal segment longest, extending beyond trochanter in its entirety. *Thorax:* Without combs or spinelets. Pro-, meso-, and metanota subequal in length along dorsal margin, each with posterior row of 5–6 setae per side plus intercalaries; anterior row of 1–2 small setae; 5–6 pseudosetae per side beneath mesonotal collar. Proepisternum without setae, dorsal depres-

sion sheaths terminal segments of antennal clavus. Mesosternum with 1 seta, anteroventral margin acuminate and sclerotized, mesepimeron with 3 setae. Distinct lateral metanotal area with 2 setae. Well developed pleural arch. Metasternum with one seta, dorsoanterior margin convex, anteroventral margin lobate. Metepimeron bearing 3 setae, dorsal margin not fused to metanotum. *Legs:* Procoxa with 16–17 setae (including marginals), 2 setae on mesal side of anterior margin. Meso- and metacoxae with numerous slender setae along anteromesal margin from dorsoanterior base to apex. Pro-, meso-, and metafemora each with single lateral seta, setae along dorsal margins, and line of setae mesally from base to apex. Paired bristles guarding femoro-tibial joint of procoxa equal in length, outer bristles of pair shorter in meso- and metafemora. Pro-, meso-, and metatibia each with a lateral vertical row of 2, 4, 4 setae, respectively. Tarsal segment V of all legs with 4 lateral plantar bristles, 2 preapical plantar bristles (subspiniform), and 2 preapical plantar hairs (Fig. 4). *Unmodified abdominal segments:* Tergites I–III with marginal spinelets (includes both sides) 3–5, 2–3, and 0–1, respectively. Intercalary setae in all posterior rows of t. I–VII, which have 4, 6, 5–6, 5–6, 5, 5, 5 setae per side, respectively. A single seta in posterior row of each tergite lies ventrad to each spiracle. Anterior rows of t. I–VII with 2–3, 2–3, 1–2, 1–3, 0, 0, 0 setae per side, respectively. One antensilial bristle per side. Per side, st. II has 1 small setae, st. III–VII each has 2, and st. VIII has 4 long setae. *Modified abdominal segments:* Tergum VIII, reduced posteriorly, not extending over body of clasper, bearing 2 small setae anterior to a vermiform spiracle and 1 stout seta posterior to the spiracle. Body of clasper, movable process, and manubrium indistinguishable from those of *J. allredi*; characterized by a small movable process, 2 acetabular bristles, a distinct fovea, anterior margin of t. X and manubrium semicircular in outline with apex of manubrium truncately rounded.

Apical lobe of the distal arm of st. IX angular at its ventral margin, truncate at the apex, and armed with a row of submarginal setae that enlarge towards the ventral marginal angle (Fig. 2). The apodemal rod of st. IX proximally fragile. The distal arm of the st. IX laterally fused to the greatly enlarged lateral lobe of the aedeagus, characteristic of the genus. *Aedeagus:* Very much like *J. allredi*, except for the pronounced lateral lobe (Figs. 2–3). Aedeagal apodeme broadest medially, tapering to a narrow neck near fulcral lobes. Penis rods exceeding aedeagal apodeme, but not coiled. Median dorsal lobe nipple-like, laterally expanded into paired distolateral lobes, lateral lobes, and a large single median lobe. The apical lobes of the distal arm of st. IX envelops the large median lobe and the apical lobes are enveloped and fused to the lateral lobes. Sclerotized inner tube is long and slender, bearing a dorsal tooth basally. Crochets lacking.

Female. Characteristics similar to those of male except as follows: Frons smoothly rounded to posterior occipital margin with minute punctations and 4 marginal placoid pits. Dorsal margin of antennal fossa lacking line of minute coniform setae, pedicel with 3 setae extending to apex of clavus, clavus shorter than in male. Segment 2 of maxillary palpus distinctly longer than others. Mesonotal collar with 7–9 pseudosetae per side. Fewer spinelets on abdominal t. I–II than in male (1–4 and 0–2, respectively). Anterior row of setae on t. III–VII range from 3–5, 2–4, 2–4, 2–3, and 2–3 per side, respectively. Tergum VIII with 3–5 setae dorsad to vermiform spiracle, a single anterior row of 7–9 setae below spiracle, and a group of 20–25 setae on caudal margin, many somewhat spiniform. Abdominal st. II with lateral patch of 6–9 setae and a single apical ventral seta per side, st. III–V each with 2–3 setae per side. Sixth sternum with distinct sinus in caudal margin surrounded by heavy sclerotization, 2 basal setae per side and a single seta above sinus (Fig. 6). Caudal margin of st. VII entire

with slight broad concavity, each side with two parallel oblique rows (2 in anterior row and 3 in posterior row). Eighth sternum bluntly rounded with 5–6 minute terminal setae. Anal stylet with long apical bristle and 1–2 minute setae. Bursa copulatrix partially sclerotized. Single spermatheca with globular bulga, broad cribriform area, hilla upturned, apex extending slightly beyond bulga, indistinguishable from nominate species (Fig. 5).

Size: (total length mm, range followed by mean, mounted specimens) ($N = 3 \text{ } \delta$, 2 $\text{ } \eta$). Male = 1.8–2.2, 2.0; Female = 2.5–2.7, 2.6. (alcohol specimens) ($N = 1 \text{ } \delta$, 3 $\text{ } \eta$). Male = 1.5, Female = 1.6–1.8, 1.7.

DISCUSSION

The Nevada Test Site has a faunal transition zone between the Great Basin to the northwest and the Mojave Desert to the southeast. *Jordanopsylla becki* occurs to the south of this transition zone. It is located 225 km from the closest known western population of *J. allredi* and south 30 minutes latitude. Subspecific designation is inappropriate as the two species are morphologically distinct and the two known populations of *J. allredi* occurring 50 km apart (within 04 minutes latitude) in Washington County, Utah do not demonstrate a variable character cline from east to west. Habitats for both Utah populations are similar (Hastriter et al., 1998) and occur within a narrow range of elevation (940–1,190 m). The new species occurs at slightly higher elevations (1,225–1,305 m) than the nominate species (author's collections). Beck and Allred (1966) provide only general reference as to where they collected *J. becki* without mention of elevation. Both species are restricted to the plant communities associated with common flora of the Mojave Desert (creosote, yucca, prickly pear cactus, and pale cholla) opposed to those of the Great Basin. *Neotoma lepida*, as suggested by Beck and Allred (1966), is undoubtedly the preferred host for *J. becki*, however, additional col-

lections are needed to elucidate the host range of this new species. The distribution of both species of *Jordanopsylla* appears to be limited by micro-environmental requirements of their immature stages, but seasonal abundance and collecting techniques may also play a role in its rarity in collections. All known specimens in the genus have been collected during the months of November ($N = 1$), December ($N = 7$) and January ($N = 10$) indicating that *Jordanopsylla* is certainly a winter flea. Among the eight specimens of *Jordanopsylla* collected by the author (*J. allredi*, 3 δ and *J. becki*, 1 δ , 4 η), four of the eight were obtained by reexamining bags or washing specimens more than 24 hours after initial attempts failed to collect them (three collected in nests). Similar tenacity also has been demonstrated for *S. alpina*. Many collectors have sought to collect specimens of *Jordanopsylla* without success. The author would suggest the technique of washing animals thoroughly to maximize the opportunity to collect *Jordanopsylla*. Although many specimens of *P. crinitus* have been collected in the same areas where *Jordanopsylla* has been collected from *P. eremicus* and *N. lepida*, fleas of this genus have never been collected from this host. The topography of much of the expanse separating the two species is lower in elevation than the type localities of either species. One might speculate that such natural isolation might have contributed to speciation of *Jordanopsylla*.

ACKNOWLEDGMENTS

Appreciation is expressed to Nancy Adams, Curator of Siphonaptera, National Museum of Natural History, Smithsonian Institution for loan of specimens and to Robert Furlow and Derek Hall, Bechtel Nevada, Nevada Test Site, for their assistance in facilitating on-site mammal collections.

LITERATURE CITED

- Beck, D. E. and D. M. Allred. 1966. Siphonaptera (fleas) of the Nevada Test Site. Brigham Young University Science Bulletin, (Biological Series) 7(2): 1-27.
- Hastriter, M. W., H. E. Egoscue, and R. Traub. 1998. A description of the male of *Jordanopsylla allredi* (Siphonaptera: Ctenophthalmidae). Proceedings of the Entomological Society of Washington 100(1): 141-46.
- Traub, R. and V. J. Tipton. 1951. *Jordanopsylla allredi*, a new genus and species of fleas from Utah (Siphonaptera). Journal of the Washington Academy of Science 41(8): 264-70.